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# DOE STANDARD

## GUIDELINE TO GOOD PRACTICES FOR MAINTENANCE ORGANIZATION AND ADMINISTRATION AT DOE NUCLEAR FACILITIES



**U.S. Department of Energy**  
**Washington, D.C. 20585**

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**FOREWORD**

The purpose of the *Guideline to Good Practices for Maintenance Organization and Administration at DOE Nuclear Facilities* is to provide contractor maintenance organizations with information that may be used to verify adequacy of and/or modify existing maintenance organization programs, or to develop new programs. This document is intended to be an example guideline for the implementation of DOE Order 4330.4A, *Maintenance Management Program*, Chapter II, Element 1. DOE contractors should not feel obligated to adopt all parts of this guide. Rather, they should use the information contained herein as a guide for developing programs that are applicable to their facility.



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## 1. INTRODUCTION

### 1.1 Purpose

This guide is intended to assist facility maintenance operations in the review of existing and in developing new organizational and administrative functions. It is expected that each DOE facility may use different approaches or methods than those defined in this guide. Explanation of the intent of the guide is provided in the Introduction and Discussion section of each chapter, and the specific guidelines that follow reflect generally accepted industry practices. Therefore, deviation from any particular guideline would not, in itself, indicate a problem. If substantive differences exist between the intent of the Guideline and actual practice, management should evaluate current practice to determine the need to include/exclude proposed features. A change to maintenance practice would be appropriate if a performance weakness was determined to exist. Development, documentation, and implementation of other features which further enhance these guidelines for specific applications, is encouraged.

This guide describes key features of programs that support maintenance organization and administration. Their implementation should enhance safe, reliable, and efficient maintenance operations. Included in these key features is guidance for the following organizational and administrative functions:

- a) Management of resources, qualifications, skill levels, and staffing.
- b) Human resources awareness, education and training to ensure clear understanding of requirements (administrative, operational, and technical).
- c) Maintenance Management for oversight and monitoring of maintenance activities and to determine root causes for undesirable conditions.
- d) Document Control for clear definition of requirements and configuration management of information used in the performance of maintenance activities.

Each function is discussed in a chapter, which in turn is organized into three sections. The **Introduction Section** briefly describes the objective to be achieved. A **Discussion Section** concisely describes actions which support the accomplishment of the objective and includes a brief explanation of its relevance. The final section of each chapter, **Guidelines**, provides typical industry guidance relative to the chapter objective and the performance objectives and criteria listed in Appendix A. In some cases, example situations accompany the guidelines. These examples have been provided only as an aid

in clear understanding of the guidelines and should not be construed as the only method for meeting the intent of the guidelines.

Persons wishing to obtain an overview of this document need only read the Introduction and Discussion section of each chapter.

Appendix B is provided for use by facility trainers who intend to provide training regarding this element.

## **1.2 Background**

The information in this guide was developed from commercial and DOE sources. Each facility should select those details that are applicable, add any unlisted knowledge or experience that are applicable, and develop and implement facility-specific maintenance documentation. Facilities that have existing documented maintenance programs should review this guide to identify details that may enhance their existing programs.

## **1.3 Application**

The content of this guide is generally applicable to all DOE nuclear facilities. Portions of the programs outlined may not be applicable to all facilities because maintenance organizations, disciplines, titles, and responsibilities may vary among DOE nuclear facilities. Facility maintenance personnel can verify the adequacy or improve existing maintenance programs by adapting this guide to their specific facility and individual maintenance disciplines.

## **2. MAINTENANCE ORGANIZATION AND ADMINISTRATIVE STRUCTURE**

### **2.1 Introduction**

Maintenance management should establish performance standards and requirements for the conduct of maintenance activities that are consistent with plant policies and objectives. The organization and administration of maintenance should ensure effective implementation of these performance standards and requirements. The organization provides the administrative and functional structure that determines where people are assigned and defines boundaries within which they are expected to accomplish their tasks. The complexity of a facility makes a clearly defined organization essential.

This section describes a basic maintenance organization and addresses certain administrative measures that contribute to effective maintenance organization management.

### **2.2 Discussion**

The maintenance organization should support effective performance and control of all maintenance activities. A clear understanding by personnel of their authorities, responsibilities, accountabilities, and interfaces is essential to proper functioning of the organization. To successfully achieve this understanding, the organizational structure and the administrative guidelines that implement the organizational functions should be clearly defined.

For the purposes of these guidelines, the person with overall responsibility for the safe and reliable operation of the maintenance organization is referred to as the maintenance division manager. The responsibilities and accountabilities of the maintenance division manager and a description of his organizational relationships with the maintenance department managers and his staff assistants are discussed in the guideline section. Specific, detailed descriptions of the authorities, responsibilities, accountabilities, and interfaces of maintenance department managers are provided in other guidelines dealing with those particular departments.

The organization of a maintenance division should support the safe, reliable, and efficient conduct of all maintenance activities. Policies and procedures should be clearly written, technically correct, and readily available so maintenance personnel can easily determine and properly implement actions required under varying circumstances. Key managers should be informed promptly of matters needing their attention. Qualified substitutes should be designated when key managers are unavailable. Provisions should be established for necessary management support and guidance outside normal working hours.

## 2.3 Guidelines

### 2.3.1 Maintenance Organizational Structure

A typical maintenance organization is composed of a maintenance division manager and various departments with department managers. Organization charts should indicate line and staff positions and interfaces within the maintenance division and with the plant organization. Interfaces with committees, such as the plant nuclear safety review group, should also be shown on the organization chart. Position descriptions or equivalent procedural guidance should be used to supplement the maintenance organization chart. Position descriptions should clearly define the authorities, responsibilities, and qualifications for each management position within the maintenance organization. Additionally, procedures and policies that describe the functions and interfaces of the organization should be implemented. Measures should be established to ensure that organization charts, position descriptions, and related procedures are maintained current.

#### a. Maintenance Division Manager

The maintenance division manager is responsible for all aspects of maintenance operations, including the safety and well-being of maintenance personnel working at the plant. The maintenance division manager should be aware of day-to-day maintenance activities. The maintenance division manager reports to the plant manager. Although, he retains full responsibility for safe and reliable operation of the maintenance division. Responsibilities of the maintenance division manager should include the following:

- 1) Establishing high standards for the conduct of maintenance activities and ensuring uniform adherence to those standards
- 2) Holding line managers accountable for performance in their areas of responsibility
- 3) Establishing goals and objectives that promote safe, reliable, and efficient maintenance operations
- 4) Ensuring the safety and well-being of assigned maintenance division personnel ensuring that the plant is maintained in accordance with corporate and plant policies and procedures and applicable regulatory requirements

- 5) Ensuring maintenance division personnel are properly trained and qualified
- 6) Developing personnel for key supervisory and management positions
- 7) Monitoring maintenance performance by performing activities such as the following:
  - a) observing personnel performing their duties
  - b) promoting personal involvement and continuing assessments by key subordinates
  - c) communicating frequently with subordinates
  - d) reviewing performance monitoring trend reports, reports from the quality program, and reports from other groups or activities
- 8) Reviewing assessments performed by outside organizations
- 9) Identifying root causes of problems, initiating corrective actions, and tracking actions to completion
- 10) Ensuring incorporation of industry operating experience into appropriate aspects of maintenance operations

b. Staff Assistants

Staff assistants may be designated within the maintenance organization to fulfill certain staff functions for the maintenance division manager. When designated, the staff assistant's duties, responsibilities, and reporting relationship should be clearly defined in position descriptions approved by the maintenance division manager. Staff assistants should not perform functions that are the responsibility of line management.

c. Department Managers

The managers of the line operations and support departments generally report to and receive instructions from the maintenance division manager. Department managers should be responsible for the activities of personnel assigned to their department. In addition, department managers should be held accountable for ensuring that plant policies and procedures are carried out.

When on-site support departments report to someone other than the maintenance division manager, they should be responsive to direction from the maintenance division manager. The relationships between maintenance management and support groups located on site should be clearly defined and understood.

d. Committees and Task Forces

Committees and task forces can be used effectively to bring together personnel from multiple disciplines to review or investigate a specific issue or problem. Committees and task forces should have a clearly defined charter and objective and should be chaired by a senior individual with proven leadership capabilities and appropriate experience in the area under investigation. Recommendations from committees or task forces should be provided to line management. Line management is responsible for evaluating and appropriately acting on recommendations made by committees.

The use of committees and task forces to manage or coordinate responsibilities that should be assigned to individual managers can dilute authority and accountability; therefore, committees should be used with prudence.

### **2.3.2 Management Succession**

a. Succession Planning

Capable individuals should be available to fill vacancies that occur in key management positions. "Human Resources," Section 3, of these guidelines provides information on the development of such individuals.

b. Temporary Replacements for Key Positions

All maintenance departments should designate individuals within their functional groups who will serve as temporary replacements if the key supervisor or manager is unavailable. Managers and their subordinate supervisory personnel should ensure their designated replacements are capable of performing adequately in the temporary position.

c. Management Outside of Normal Working Hours

Clear guidance should be provided to maintenance division personnel concerning the authority and responsibility for the safe and reliable conduct of maintenance activities outside normal working hours. Managers should establish policies and procedures as necessary to ensure that they are adequately informed during off-hours of matters under their cognizance needing management attention. The maintenance division manager and other responsible department managers and supervisors should be promptly notified of station events when such notification is considered appropriate. Subordinates should be required to keep management informed of any aspect of maintenance activities that involves initiation of the emergency plan or results in a significant departure from normal operation.

Although maintenance division and department managers should be notified promptly of significant station events, it should be understood that subordinates are responsible for taking appropriate action and documenting the event and actions taken. Maintenance division records and logs should be used at all times as the primary method for documenting routine activities in progress, changes of status, and abnormal or unusual occurrences.

**2.3.3 Maintenance Division Resources**

The maintenance division manager should be responsible for identifying to the plant manager the resources required for safe and reliable maintenance operations. The resources provided should include the following:

- a) Sufficient numbers of personnel to limit overtime
- b) Adequate permanent facilities to conduct maintenance activities
- c) Necessary spare parts and equipment for plant maintenance
- d) Administrative services including contract administration, budget and cost control, personnel administration, and interface with regulatory organizations

#### **2.3.4 Professionalism in the Performance of Maintenance Division Activities**

Maintenance management should assist the plant manager in establishing high performance standards for all maintenance activities and effectively communicate these standards throughout the organization. Examples of areas in which management standards should be established include the following:

- a) Conduct of maintenance and shift turnover
- b) Use of and adherence to procedures
- c) Investigation of abnormal indications or situations
- d) Record and log keeping practices
- e) Industrial safety and radiological protection practices
- f) Plant materiel, housekeeping, and cleanliness conditions

Maintenance management should promote and require uniform adherence to these high standards. Safe and reliable maintenance operations should be the primary goal. Maintenance activities should be conducted in a business-like, professional manner. Non-job-related activities that could distract from the task at hand should not be allowed in the work place.

Management should foster a working environment that encourages individual performance and teamwork to achieve primary goals of safe and reliable maintenance operations. Professional codes that complement and support management standards should be developed for the various groups of maintenance personnel.

#### **2.3.5 Maintenance Division Communications**

Maintenance management should communicate goals, standards, and policies to individuals and groups within the organization. Written and verbal communications by management should be stated clearly so that working level personnel understand and support plant goals, standards, and policies. Management should encourage an atmosphere that is conducive to constructive criticism and feedback. Management should be responsive to feedback, and the results of the feedback should be communicated back to plant personnel to encourage their continued input.

Interdepartmental communications should provide personnel with necessary information from other departments needed to perform their specific functions. Appropriate planning and scheduling activities and interdepartmental meetings should be conducted to effectively coordinate maintenance division activities.

### **2.3.6 Administrative Controls**

#### **a. Purpose**

Maintenance division administrative controls should ensure effective planning and control of maintenance activities. The administrative controls that affect safe and reliable plant operation are of particular importance. However, any administrative controls that would improve personnel performance or more clearly define responsibilities should be considered. Administrative controls for specific areas are discussed in more detail in the appropriate sections of these guidelines.

#### **b. Format**

Maintenance division administrative controls should be written in a consistent format to assist in their effective development and implementation. The required format for the different types of administrative controls (e.g., policies, procedures, and checklists) should be clearly defined. Administrative controls should be written in a manner that is easily understood and that adequately addresses the subject matter. Lower-tier administrative procedures should be consistent with those at the plant level to ensure continuity among various plant departments and activities.

#### **c. Content**

The content of maintenance division administrative controls should provide the expected users with easily understandable information. The use of a writers guide or similar document has proven to be helpful in achieving effective results. Standard names for plant work groups, positions, locations, systems, and equipment should be established and used.

## d. Use

Once established, use of administrative controls should be required. Managers and supervisors should require uniform adherence to all plant policies and procedures. Guidance should be provided to specify when and how changes can be made to administrative controls. For example, methods should be available for making temporary changes or permanent revisions to procedures when required. Administrative controls that are no longer needed or have been superseded should be canceled and removed from use in a timely manner. Records should be maintained to allow a historical review of appropriate documents. Methods should be implemented to ensure maintenance division commitments are not inadvertently deleted by changes or revisions.

**2.3.7 Procedures**

Procedures are a key factor affecting worker performance. Procedures should provide sufficient direction to help ensure the plant is operated and maintained properly and to effectively support maintenance activities. Maintenance procedures should be developed for those activities that affect the entire maintenance division or that are applicable to multiple departments. Each department should develop procedures for the activities specific to the functioning of that department. Procedures should receive appropriate interdepartmental reviews to enhance technical accuracy and human factors considerations.

Requirements for the use of procedures should be clearly defined and understood by all personnel. Procedures should be referenced during infrequent or unusual activities when individuals are not familiar with the activities and during complex activities. Although procedures need not be in hand while conducting other activities, they should be followed. Guidance should be provided concerning which procedures fall into each of these categories. Procedures that are found to be inadequate or incorrect should be corrected prior to use, and permanent revisions should be initiated in a timely manner. Deficient procedures or failure to follow procedures have been major contributors to many significant operational events in the industry. Detailed guidance on the development, content, and use of procedures can be found in DOE *Writer's Guide for Technical Procedures*. This Guide supports DOE Order 5480.19, *Conduct of Operation*, and DOE Order 4330.4A, *Maintenance Management Programs*.

### **2.3.8 Non-Facility Personnel**

Non-Facility personnel may be used to perform tasks that are of a specialized or temporary nature for which it is not feasible to hire or maintain a full-time maintenance division employee. The use of non-facility personnel in permanent maintenance division positions should be avoided except as an interim measure. Chapter 3, "Human Resources," provides additional guidance concerning placing non-facility personnel in permanent positions.

When non-facility personnel are used, the duties, authorities, responsibilities, and functional interfaces with personnel should be clearly defined. Non-Facility personnel should be qualified for the task to be performed and held to the same performance standards as maintenance division personnel performing similar tasks. Non-Facility personnel should be indoctrinated in appropriate plant policies and procedures and should adhere to the policies and procedures to the same degree as maintenance division personnel.

### **2.3.9 Interfaces with Outside Organizations**

The maintenance division staff interface with many outside organizations, such as the bargaining unit, federal regulatory agencies, state regulatory agencies and commissions, local governmental bodies, industry oversight and advisory groups, and insurance companies. The responsibility for interfacing with and making commitments to outside organizations should be clearly defined and understood. Measures, including appropriate reviews, should be in place to ensure information provided to outside organizations is complete and accurate. Maintenance division management should not acquiesce to outside organizations to the extent that management's primary responsibility - personnel safety and plant safety and reliability - is compromised.

### **2.3.10 Technical Safety Requirements**

Administrative controls should be established to document compliance with DOE Order 5480.22 *Technical Safety Requirements*. Logs, status sheets, turnover checklists, or other appropriate documentation should reflect the entry conditions and actions taken in response to technical safety requirements. Appropriate managers and supervisors should be apprised of applicable technical safety requirements and maintenance actions required for a return to normal operation.

### **3. HUMAN RESOURCES**

#### **3.1 Introduction**

Human resource management programs should be in place to ensure that the maintenance division is staffed by well-qualified and experienced personnel. This section covers the important aspects of human resource management for a maintenance facility.

#### **3.2 Discussion**

The maintenance division should be staffed, or supported by a team of highly qualified and experienced personnel to achieve safe, reliable, and efficient maintenance operations. Recruiting and screening efforts should support maintenance division needs to ensure that qualified job candidates are hired. Human resource efforts should emphasize retention and development of employees. Once hired, personnel performance should be evaluated through regular performance appraisals. Promotions should be based on an individual's performance and ability. Managerial, supervisory, and technical skills should be developed through regular training, qualification, special projects and assignments, and rotation of job assignments. Human resource policies and programs should be effectively communicated to personnel. Human resource programs should be monitored and periodically evaluated to determine their effectiveness. Policies should be in place to identify and deal with behavioral abnormalities, including drug use and alcohol abuse.

#### **3.3 Guidelines**

##### **3.3.1 Long-range Staffing Plan**

A long-range staffing plan, tied to the company's long-range objectives, should be developed by the maintenance division to anticipate future personnel needs. This plan should be periodically reviewed and updated to verify that it is consistent with and supports company long-range objectives and the needs of the plant. Elements of the long-range plan should include anticipated changes in authorized staffing levels, potential succession plans for key management positions, job rotation for professional and managerial experience development, and a forecast of personnel needs, considering losses due to retirement and attrition. The long-range staffing plan should allow sufficient time for individuals to turn over job responsibilities and allow for continuity in the conduct of duties.

Engineering support is not always directly assigned to the maintenance functions. Such support availability and priority should be one of the

considerations in Plant Level Business Planning input/need from the maintenance organization.

### **3.3.2 Inventories of Positions and Personnel**

An inventory of maintenance division positions and position requirements and of current personnel and associated skills is necessary for effective human resource planning. The inventory of maintenance division positions should identify the education level, nuclear related and other plant experience, licenses or certifications, and personal characteristics expected for each key position. The personnel inventory should include the education level, work experience, performance appraisal results, training, licenses and certifications, and career desires for each employee.

### **3.3.3 Personnel Recruiting**

The personnel department is responsible for the timely recruitment, screening, and initial interviewing of potential job candidates. Maintenance division management is responsible for final selection of capable and qualified personnel to staff the maintenance organization. The activities of the personnel department require that department personnel work closely with all maintenance departments. The personnel department should be aware of attrition rates, vacancies, and planned changes in staffing of the maintenance organization. If a maintenance personnel department exists separately from the corporate personnel department, the maintenance personnel department activities should support and complement efforts of the corporate personnel department to ensure maintenance staffing needs are met and factored into the company's overall human resource management activities.

### **3.3.4 Selection of Personnel**

Screening of job candidates should include verification of educational and professional background, suitability for the plant's culture and environment, ability to perform the task, potential for advancement, trustworthiness, and fitness for duty. Whenever practical, preselection testing should be used to assess the candidate's potential for success. The selection process should include interviews by the personnel department and maintenance line management.

### **3.3.5 Personnel Training and Qualification**

Formal training and qualification programs should be implemented to develop and improve the knowledge and skills necessary to perform assigned functions. Programs for initial and continuing training should be based on identified needs. Plans should be implemented to achieve and maintain accreditation of key training programs. Training programs should include provisions for systematic evaluation of training effectiveness and for using feedback from job performance to refine programs.

### **3.3.6 Management and Professional Development**

Management and professional development measures should be implemented to ensure the maintenance division is manned by highly capable and experienced individuals with a broad background and perspective in plant operations. Such measures should be directed at enhancing the managerial and technical skills of maintenance division personnel and should normally include training in managerial and supervisory skills, written and oral communications, and specialized technical subjects. The unique needs for each level of management and for each individual should be considered in the management development program.

Management development activities should prepare a pool of selected individuals for designated line management positions. An assessment should be made of maintenance management needs, and key line management positions should be defined. Job prerequisites, including necessary training, experience, professional certifications, and skills development, should be defined. Criteria should be established for the selection of personnel to participate in management development activities. The training and job rotation assignments that constitute management development activities should be defined and communicated to participating personnel. Available resources should be adequate to support the training and career broadening assignments necessary for development of selected personnel.

A goal of the management development effort should be to have qualified personnel in the maintenance organization ready to be promoted (or with the potential to be promoted) to the next level of management.

### **3.3.7 Performance Appraisals**

All personnel should periodically (for example, at least annually) receive a systematic and objective performance appraisal. These appraisals should be used to provide feedback to the individual to help improve job performance. Performance appraisals should also be used to enhance communications between supervisors and subordinates, evaluate performance against management goals and objectives, and guide the individual's professional development. Results of performance appraisals should be considered in job promotions and special assignments. Periodic feedback on performance, in addition to the formal performance appraisal process, is also important to provide an ongoing appraisal of the subordinate's performance, including strengths and areas needing improvement.

### **3.3.8 Compensation and Reward System**

To attract and retain top performing personnel, the organization's compensation system should be competitive with those of other employers in the local community and in competing industries. Additionally, the compensation and reward system should be internally equitable within the maintenance organization, recognizing the unique contribution of each position to overall performance.

### **3.3.9 Communication of Personnel Management Policies**

Maintenance management should clearly and effectively communicate the objectives of the company's human resources management effort to maintenance employees. Personnel should thoroughly understand top management's intention concerning career progression, management and professional development activities, performance appraisals, and the compensation and reward system.

### **3.3.10 Evaluation of Human Resources Management Activities**

Human resources management activities should be monitored and periodically evaluated. The results of the evaluations should be reported to the plant manager and corporate management.

The effectiveness of the following activities should be included in the evaluation:

- a) Human resource recruiting, selection, and training
- b) Management and professional development
- c) Retention of personnel
- d) Performance appraisals

The organization's compensation and reward system should be periodically reviewed to ensure it is equitable and competitive.

### **3.3.11 Use of Non-Facility Personnel**

Maintenance management should strive to fill permanent staff positions with permanently assigned maintenance personnel. Non-Facility personnel should normally be used only to fill temporary needs for which qualified permanent personnel are unavailable (e.g., to provide specialized technical skills or to supplement maintenance staff during periods such as outages) or when the costs of non-facility personnel doing the work are demonstrably less than if the work was performed by permanent maintenance personnel. For situations in which non-facility personnel are filling permanent positions or filling a temporary position that will be made permanent, staffing plans should include ultimate replacement of the non-facility person with permanent maintenance personnel. Use of non-facility personnel should be reviewed periodically by maintenance management to verify continued need.

Training requirements for non-facility personnel should be appropriate to the tasks they are assigned and the level of responsibility they exercise. Training and qualification for these individuals should be commensurate with that of permanent maintenance division personnel performing comparable tasks.

## 4. MAINTENANCE MANAGEMENT ACTIVITIES

### 4.1 Introduction

Management activities should support a high level of plant performance and promote a climate of professionalism. Management direction for maintenance activities should clearly define management's expectations for the level of performance to be achieved. Management direction is expressed through policies, directives, goals and objectives, and day-to-day interactions. Managers should conduct frequent direct observation of day-to-day activities and maintain an awareness of plant conditions. A monitoring program should be in place that includes monitoring and trending of appropriate parameters to assess performance. The monitoring program should help identify performance problems and provide appropriate information for implementation of needed improvements. Assessment of the monitoring program results should help ensure that root causes of problems are identified and that corrective action is timely. Follow-up monitoring should be performed to verify the effectiveness of corrective actions taken. This section outlines the key elements of maintenance management activities. Appendix A of this document provides the Performance Objective and Criteria for DOE facility Maintenance Organization and Administration. DOE *Guideline to Good Practices for Management Involvement at DOE Nuclear Facilities* contains more detail information on maintenance management responsibility.

### 4.2 Discussion

#### 4.2.1 Management Direction

Management expectations for the level of performance in maintenance activities should be clearly defined in management policies and directives. Maintenance procedures should reflect these expectations, as should day-to-day interactions by managers/supervisors with the work force. All maintenance personnel on site, non-facility as well as permanent personnel, should be accountable for strict adherence to policies and procedures.

A maintenance goals and objectives program should provide management a mechanism to establish plant priorities and monitor progress toward accomplishment of defined objectives. Goals should be realistic but challenging. In many cases, a maintenance goal will support a specific plant goal or objective. Action plans should be developed that specify the actions and responsibilities for achieving significant or complex goals and objectives. A formal goals and objectives program is an effective method of communicating direction and progress to all personnel.

#### **4.2.2 Management Monitoring**

To provide the proper direction, management should develop and monitor information sources to support decision making, both on a day-to-day basis and for the long term. Management monitoring of maintenance activities should ensure activities are conducted in accordance with desired management standards and established policies and procedures and should facilitate early identification and correction of problems.

There should be a high degree of management involvement in and observation of day-to-day maintenance activities. A manager's routine should include tours of the work place and discussions with personnel assigned to conduct maintenance activities.

Management monitoring of maintenance activities should also include a program for monitoring maintenance performance through reporting and trending of selected parameters. The monitoring program should provide maintenance data that is trended, analyzed, and forwarded to appropriate levels of management.

#### **4.2.3 Management Assessment**

The information provided by the management monitoring program should be assessed to determine the root cause(s) of performance problems or adverse trends and necessary corrective actions. Follow-up monitoring is necessary to determine the effectiveness of corrective actions. Management assessment should include the effective use of lessons learned from in-house and industry operating experience.

#### **4.2.4 Management Control of Plant Configuration**

To ensure that plant structures, systems, and components continue to conform to approved design requirements and are properly reflected in maintenance procedures, drawings, vendor technical manuals and training materials, management should implement a program for identifying these requirements and controlling change.

### **4.3 Guidelines**

#### **4.3.1 Management Direction**

Management should establish and clearly communicate high standards of performance and promote a climate of professionalism for the conduct of all maintenance activities. Standards of performance and a professional climate should be fostered by leadership within the maintenance organization as opposed to external forces or influences. Managers should provide leadership by example. Important actions that can contribute to the achievement of excellence include the following:

- a) Encouraging team work at all levels of the maintenance organization
- b) Instilling an attitude of healthy skepticism
- c) Fostering open communications within the maintenance staff and with the plant management staff
- d) Recognizing excellent individual performance, particularly as it contributes to the team effort
- e) Developing a sense of ownership within work groups

Management policies and directives covering the conduct of maintenance activities should reflect desired high standards. Goals and objectives that focus on areas in need of improvement and that promote excellence in plant maintenance operations should be in place.

#### **a. Policies, Directives, and Procedures**

Management policies and directives should provide clear guidance for the conduct of maintenance activities. Management-approved procedures for the performance of detailed and important maintenance activities should be prepared on the basis of these policies and directives. All maintenance personnel on site, non-facility as well as permanent personnel, should be held accountable for strict adherence to policies, directives, and procedures. Management should actively promote adherence to policies, directives, and procedures through coaching, through monitoring of maintenance activities, and by example.

**b. Goals and Objectives**

The maintenance division manager and his staff should develop goals and objectives that support and complement established plant goals. Plant goals often include financial, manpower, production, public safety, personnel safety, and regulatory matters. In addition, key maintenance performance areas and areas in which need for improvement is recognized should be included in plant goals and objectives. Suitable goals and objectives should be established by responsible department managers to support plant goals. Department goals and objectives should be coordinated among the departments to ensure that they are consistent, mutually supportive, and reflect management's priorities.

When the performance of support groups (not reporting to the maintenance division manager) directly affects maintenance activities, the goals and objectives of those support groups should be reviewed by the maintenance division manager. This review should ensure that the goals and objectives are consistent with and complementary to those developed by line management of the maintenance division.

Characteristics of effective goals and objectives include those that are:

- 1) Measurable and stated in terms that allow specific measurement of progress and clear determination of achievement
- 2) Challenging, but achievable, and aim for specific improvement in performance; should not be set so high that achievement is unrealistic and, therefore, not actively pursued
- 3) Pertinent and should support the overall mission of the maintenance organization
- 4) Limited in number to prevent diluting efforts on key areas
- 5) Within the control of the individual or group responsible for their accomplishment
- 6) Clearly communicated to and understood and supported by all members of the maintenance organization
- 7) Based upon input from all levels in the maintenance organization responsible for implementing the goals and objectives

Where appropriate, action plans should be developed for goals and objectives, and actions required of multiple departments should be clearly defined. The action plans should specify actions and responsibilities of each party contributing to achievement of the objective. Milestones should be established to assist in tracking progress.

Each department manager should ensure that departmental personnel are aware of and support the actions necessary for achievement of department and plant goals and objectives.

The maintenance division manager and department managers should periodically review progress toward accomplishment of goals and objectives. Formal reviews of progress should be conducted at least quarterly, and results should be periodically communicated to maintenance personnel.

Department managers should make recommendations to the maintenance division manager when changes to division or department goals and objectives are deemed necessary. Proposed changes should be approved only after a review of conditions that have changed since the time the goals and objectives were established and an assessment of the impact of the revised goals and objectives on the overall performance of the plant has been completed.

Personnel should be held accountable for the achievement of goals and objectives assigned to them. Personnel should likewise be recognized for achievement of goals and objectives and for actions performed in support of that effort. Accountability and recognition should be administered in a manner that complements the personnel performance appraisal system.

#### **4.3.2 Management Monitoring**

Managers should be knowledgeable of personnel performance, maintenance activities, and plant conditions within their area of responsibility. Direct involvement and coaching should be used to reinforce management standards and assess performance. Managers should have frequent and direct involvement with the work activities under their cognizance. Managers should control external demands on their time so that their presence at the plant and ability to monitor ongoing activities is not impacted. Managers and supervisors should clearly understand their responsibility for setting a professional example for others to follow. Managers and supervisors should monitor and correct problems of non-adherence to plant policies whenever observed.

**a. Management Tours**

Managers should periodically monitor important activities and functions during plant tours. The frequency and scope of management tours should be based on the importance of the equipment and activities to safe and reliable plant operation and on the extent of current problems in these areas. The practice of conducting tours of plant areas should be a planned part of each manager's routine.

Management tours should cover areas such as critical plant operations areas, as well as less frequented areas. Tours should also include radiologically controlled and relatively inaccessible areas. Some tours should be conducted on back shifts and weekends. In addition to observing performance of personnel in their specific jobs, industrial safety conditions and practices, radiological conditions and practices, materiel conditions and housekeeping should be closely observed during management tours to ensure expected standards are maintained.

Deficiencies noted during these tours should be documented and provided to responsible managers and supervisors for correction. Items that are corrected during the tour should also be documented for information purposes. Follow-up should be conducted to ensure timely and effective corrective action has been achieved.

**b. Performance Monitoring**

Activities monitored should include those performed by non-facility as well as permanent personnel, with emphasis on activities that affect safe and reliable plant operation. Monitoring should include actual observations of work in progress. Firmly scheduled blocks of time of one to three hours have proven effective for observations of activities. Observations should be followed by associated follow-up and reporting actions. Each manager should also occasionally monitor activities in an area for which he is not responsible to provide a fresh look at the performance of the activity.

Routine activities that should be monitored include the following:

- 1) Operational evolutions or work in progress to observe radiological protection and industrial safety practices, procedural adherence, work habits, teamwork, and communications
- 2) Shift turnovers in work locations to observe formality, thoroughness, and continuity of activities

- 3) Work planning and scheduling
- 4) Training activities (classroom and on-the-job)

Some non-routine activities that should be monitored include the following:

- 1) The implementation of new or revised procedures or processes to evaluate effectiveness and assess results
- 2) Activities that involve coordination of actions in different locations, such as fire drills or other station emergency drills
- 3) End-of-outage inspections of plant areas for work completion, materiel condition, and housekeeping and cleanliness

**c. Quantitative Indicators**

A program should be in place to regularly provide management with accurate information regarding key maintenance indicators. Such information should be measurable and used to assess maintenance performance and identify areas requiring management attention. Overall indicators relevant to maintenance performance, indicators to measure progress in achieving goals and objectives, and specific indicators for monitoring current performance problems and performance in specific functional areas should be selected. Information should be presented in a way that provides ready recognition of trends and comparison of actual versus expected results and, where appropriate, clearly indicates corrective action and the results of these actions.

For most quantitative indicators, a graphic format is preferable to show comparisons between actual results, plant goals, and overall industry progress over a period of time. Quantitative indicators should be presented in a way that shows a significant time period, such as 12 to 36 months, to support more meaningful analysis of performance trends. Where data is subject to wide variations over time, averaging techniques should be used to smooth the data and facilitate the identification of trends.

Monitoring reports based on quantitative indicators should be issued on a periodic basis. In most cases, updating quantitative indicators monthly has been found to be most effective. Quantitative indicators should be trended to permit early identification of trends requiring corrective action. A management summary that highlights trends and explains reasons for

undesirable trends, including problem areas, needed improvements, and actions taken to cause improvement, enhances the usefulness of the reports.

Responsibilities should be assigned for collection and analysis of data for each indicator. A coordinator should be assigned overall responsibility for development, production, and distribution of the report.

Reports tailored to the needs and desires of responsible company management, including the plant manager, and appropriate division managers, should be distributed.

Guidelines should be developed for determining what quantitative indicators are provided to each level of management. For example, the plant manager's report could provide overall performance indicators and other selected indicators along with an executive summary section noting unusual results and significant trends. A brief explanation of the cause of negative trends and corrective actions to be taken should be provided. Reports to other division managers should provide all the information in the plant manager's report and other selected indicators applicable to their areas of responsibility.

**d. Status Reports to Managers**

Managers should receive periodic reports on the status of various programs and on the status of action items. An integrated management information system is often used to provide this information. When independent reporting or action tracking systems are used, care should be taken to minimize redundant reports. Items that are nearing the completion date should be monitored to verify that due dates will be met. When items become overdue, they should be reviewed, appropriate actions should be taken, and the item should be rescheduled. Closeout methods should be streamlined to prevent an excessive number of completed items from being carried forward.

**e. Follow-up**

Follow-up on the effectiveness of corrective actions for deficient conditions should be scheduled as part of the management monitoring program. Follow-up monitoring should determine if the immediate condition has been corrected and the root cause(s) eliminated. In some cases, this will require monitoring of the immediate corrective actions and subsequent monitoring to determine whether recurrence of the condition is minimized. For the latter, sufficient time will need to be allowed to permit

the completion of all corrective actions. Based on the results of the follow-up monitoring, the item can be closed or new corrective actions formulated.

#### **4.3.3 Management Assessment**

Undesirable performance trends noted in quantitative indicators or as a result of management performance monitoring should be assessed to determine the root causes of this performance. Corrective actions should be developed and implemented to correct undesirable conditions.

##### **a. Determination of Root Causes of Problems**

Problems that are identified by management assessment or by outside organizations should be analyzed to determine underlying root causes so effective corrective actions can be developed and implemented. The root causes can be defined as those causal factors that, when corrected, will preclude a recurrence of the problem. Particular emphasis should be placed on problems or causal factors identified as having generic implications.

Root cause determination methods should be applied to event investigations, undesirable trends in quantitative indicators, and performance deficiencies noted in monitoring reports. For example, if a deficient condition exists because of personnel performance, the root cause may be due to one or more of the following examples:

- 1) Erroneous, incomplete, or unusable procedures
- 2) Insufficient or incorrect training
- 3) Insufficient supervision caused by lack of monitoring, accountability, or improper standards
- 4) System or equipment design deficiencies

##### **b. Corrective Actions**

Corrective actions should address the root causes rather than the symptoms of the problem. Input should be considered from appropriate plant and staff members when determining corrective actions. Corrective action should be developed with input from those tasked with implementing the actions to achieve ownership of the corrective actions. Plant line management should approve corrective actions and ensure the actions are implemented in a timely manner. Input from organizations, such as quality

assurance or a corporate support/oversight group, should be considered when determining actions in response to deficient conditions identified by these organizations. Corrective actions should be tracked by management until completion.

Responsible managers and supervisors should be held accountable for the timely and effective implementation of corrective actions. Delays in the completion of approved corrective actions should be brought to the attention of the responsible manager who assigned the corrective actions. An escalation process should provide higher levels of management attention to problem areas for which corrective action continues to be ineffective.

**c. Use of Operating Experience**

Programs should be in place to ensure the timely review of operating experience to incorporate lessons learned into maintenance programs and practices. Reviews should include in-house and external industry events. Management should use industry operating experience and in-house events as a mechanism for assessing performance to determine the root causes of problems. Mechanisms should also be in place to ensure that significant in-house events are promptly provided to the industry for use by other plants.

Another aspect of operating experience involves visits to or communications with other plants. Maintenance division managers, supervisors, and workers should take opportunities to visit and communicate with other plants both to help solve specific problems and to learn different approaches to the routine business of operating plants.

**4.3.4 Management Control of Plant Configuration**

Management should ensure that plant configuration, including the manner in which the plant is maintained, conforms to the established design basis requirements. Many routine activities, if carried out improperly, can have an adverse impact on plant configuration and cause eventual equipment damage or increase the probability or consequences of a significant event. Effective control of plant configuration requires rigorous attention to detail as well as the understanding and commitment of every member of the maintenance organization to observe and report/record material condition assessment status.

**a. Configuration Management Policy**

The maintenance policy regarding the control of plant configuration should be clearly defined and communicated to all levels of the organization. The policy should address the scope of configuration management controls, the responsibilities of the maintenance organization, and the principal interfaces between the plant and maintenance organization that directly control material condition assessments and plant design base requirements. In addition the policy should identify each maintenance line manager's responsibility for implementing the necessary controls to ensure effective implementation of the configuration management policy.

**b. Availability of Design Base Requirements**

The current plant design base requirements should be readily available to the maintenance staff. These requirements should be used in the preparation, review, and approval of proposed changes to plant design and maintenance procedures. In addition, these requirements should be used in troubleshooting problems and validating material condition assessment when questions arise. The organization responsible for controlling the design base requirements and ensuring plant design integrity (i.e., the design authority) should be assigned the responsibility for interpreting design base requirements as needed.

**c. Control of Interfaces**

The interfaces among plant, permanent maintenance, and non-facility organizations should be clearly defined to ensure the complete and accurate communication of plant configuration-related information. For example, a change to a vendor manual may result in changes to maintenance procedures, training materials, equipment lists, repair parts, and design base documents such as specifications and drawings. In addition, information may flow in both directions across organizational interfaces. For example, information related to a design change may be needed by operations, maintenance, and/or training to update procedures to conform with the plant design base requirements. Conversely a procedure change initiated by maintenance personnel that affects an operating parameter may necessitate validation by design engineering personnel to verify expected operating conditions fall within the design base requirements. Controls should be established to ensure the necessary source information that initiates a configuration change is sent to all affected organizations and to ensure that the appropriate reviews, actions, and document updates are accomplished in a timely manner.

**d. Change Control**

Management should ensure proposed changes to the plant configuration are warranted and properly controlled. As noted in "Control of Interfaces" above, many activities performed during day-to-day maintenance operations of the plant can have an adverse impact on plant configuration, material condition, and plant design bases if planned or performed improperly. Management should routinely review the conduct of these activities to ensure inadvertent and uncontrolled changes to the plant are not made.

**e. Document Control**

Management should ensure documents are verified to be the current approved version prior to use. Discrepancies between actual plant configuration and controlled documents should be identified, tracked, evaluated, and expeditiously resolved. Since information describing plant configuration is frequently duplicated in documents controlled by different organizations, a method of cross-referencing documents should be established to aid in the identification of documents affected by change. Additional guidelines for controlling documents are provided in Section 5, "Document Control."

## **5. DOCUMENT CONTROL**

### **5.1 Introduction**

The maintenance document control program should ensure technically correct and readily accessible information is provided to support maintenance activities. This section covers the important aspects of a document control program.

### **5.2 Discussion**

Technically accurate and approved information written in a clear and concise format is needed to support safe and reliable maintenance operations. A document control system should be established to ensure that only authorized technical information is available for the performance of maintenance activities. Information controlled should include maintenance procedures, maintenance records and documentation, drawings, vendor technical manuals, and maintenance correspondence.

A formal process should be in place for the preparation, review, and approval of maintenance procedures and procedure revisions. Additionally, procedures should be periodically reviewed to ensure continued accuracy and usability.

The document control system should also ensure maintenance documentation, including incoming and outgoing mail, maintenance records and reports, is properly stored and easily retrievable.

Drawings should be controlled to ensure they reflect the current configuration of plant structures, systems, and equipment. Similarly, vendor manuals used for maintenance activities should be controlled to ensure they are applicable to installed equipment and contain complete and up-to-date technical information.

### 5.3 Guidelines

#### 5.3.1 Document Control Administration

A document control system should provide for the timely receipt, processing, distribution, retention, storage, and retrieval of documents originating both within and outside the maintenance organization. The responsibility for document control may be shared by more than one department. For example, one department may be responsible for the control, updating, and distribution of drawings. Another department may be responsible for maintaining maintenance procedures and retention and storage of maintenance documents. In either case, controls should be established outlining the responsibilities and authorities of individuals or groups associated with document control. A master control file of maintenance documents should be maintained, with access limited to designated personnel. Satellite files of controlled maintenance documents such as procedures, drawings, and technical manuals should be established as necessary to support maintenance operations. Responsibility for maintaining satellite files should be clearly defined.

#### 5.3.2 Procedures

Controls should be established for the preparation, review, approval, distribution, and revision of maintenance procedures. A systematic program should be used to ensure the review and updating of maintenance procedures at regular intervals that are not to exceed a specified period (normally two years). Guidelines for procedure review should address the scope and depth of the review in areas such as technical and administrative content and human factors. DOE Standard *Writer's Guide for Technical Procedures* may be of assistance in this area.

A uniform procedure format should be used for all maintenance procedures. A maintenance administrative procedure should be developed that provides guidance in the prescribed methods of format, content, and numbering. Departmental procedures should provide the detailed guidance regarding the conduct of maintenance activities.

### **5.3.3 Drawing Control**

Only controlled drawings reflecting as-built conditions should be used for maintenance operations. Drawings should be stamped or otherwise marked to clearly indicate that the drawing is controlled. Drawing indexes should be readily available and maintained current to allow quick verification of drawings for use. Satellite files of controlled drawings should be established as necessary to support maintenance activities. If satellite files are used, they should be periodically checked to ensure drawings are maintained up-to-date.

Controls should be established for distribution and updating of drawing files. Responsibility for maintaining satellite files should be clearly established. If document control personnel are not responsible for maintenance of satellite files, some means of positive verification should be used, such as return of outdated drawings. Drawings that are posted at various locations in the plant should also be controlled.

Drawings that are not part of the controlled drawing system should be considered uncontrolled and clearly identified as such. Maintenance procedures should indicate how controlled and uncontrolled drawings are identified so that personnel can readily determine the status of drawings. Uncontrolled drawings should not be used for the performance or planning of maintenance work activities.

### **5.3.4 Vendor Information**

The receipt, processing, and distribution of vendor technical information relating to the systems or components installed at the plant should be controlled to the same level as facility documentation applicable to the same structure, system or component (SSC). The proper performance of maintenance activities is strongly dependent upon the availability and use of accurate vendor technical information.

The application of controls on vendor manuals depends on the intended use of the manual. If detailed procedures have been developed for use in the conduct of maintenance, then vendor manuals should be used only as reference source material and so marked. If vendor manuals are intended as replacements, substitutes, or supplements for maintenance procedures, then their use should be controlled in the same manner as maintenance procedures. In both cases, vendor manuals should be reviewed for completeness and technically reviewed for accuracy and applicability prior to initial use. Vendor manuals should be treated as maintenance documents, with maintenance management retaining responsibility for maintaining the manuals current. Local changes should be approved and used as necessary to reflect equipment modifications and other relevant technical information.

Indexes listing all vendor manuals should be developed. Controlled manuals should be readily identifiable with a means provided to allow verification that each manual is complete and current. Manuals not included in the document control system should be considered uncontrolled and should not be used as guidance to perform maintenance on plant equipment. Maintenance procedures should indicate how controlled or uncontrolled manuals are identified.

Control mechanisms should be developed to ensure that changes required in vendor technical manuals (whether generated by external means, such as vendor technical bulletins, or changes resulting from plant modifications) are incorporated. Changes to all manuals should receive the same review and approval as the manual itself.

**APPENDIX A**  
**MAINTENANCE PERFORMANCE OBJECTIVE AND CRITERIA**



**MAINTENANCE PERFORMANCE OBJECTIVE AND CRITERIA**

- A. 1 MAINTENANCE ORGANIZATION AND ADMINISTRATION
- A. 2 MANAGEMENT OBJECTIVES
- A. 3 MANAGEMENT ASSESSMENT
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A.1 MAINTENANCE ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE

The maintenance organization and administration should ensure effective implementation and control of maintenance activities.

CRITERIA

- A. The organizational structure is clearly defined.
- B. Staffing and resources are sufficient to accomplish assigned tasks.
- C. Responsibilities and authority for each management, supervisory, professional and craft position are clearly defined and understood.
- D. Interfaces with supporting groups are clearly defined and understood.
- E. Administrative controls are employed in the conduct of maintenance activities that affect safe and reliable plant operation. Examples of such activities include scheduling of preventive maintenance, use of special tools and lifting equipment, and use of measuring and test equipment.
- F. Performance appraisals are effectively used to enhance individual performance.
- G. Temporary and other non-plant personnel use the same (or equivalent) plant-approved policies, procedures, and controls and the same workmanship standards as plant maintenance personnel.
- H. Personnel are actively encouraged to develop methods to improve safety, reliability, quality, and productivity.
- I. Performance indicators are reviewed and used to improve maintenance performance.

## A.2 MANAGEMENT OBJECTIVES

### PERFORMANCE OBJECTIVES

Formal management objectives should be used to improve plant maintenance performance.

### CRITERIA

- A. Specific objectives for maintenance organizations are published and kept current.
- B. Objectives address areas where improvement is needed. Objectives are challenging and set at the level of performance desired by management. Objectives are stated in measurable terms.
- C. Where appropriate, action plans with specific milestones are used to help achieve objectives and improve the level of performance.
- D. Maintenance division objectives are consistent and complement corporate and plant objectives.
- E. Responsibilities are assigned for achievement of specific objectives. Assignments reflect actions needed by each contributing department to achieve common objectives.
- F. Personnel understand the actions necessary, within the scope of their duties and responsibilities, to achieve the objectives.
- G. Managers and supervisors are held accountable for the achievement of assigned objectives.
- H. Management reviews are periodically conducted to assess progress toward achieving objectives and to determine changes in planned actions necessary to achieve them.

### A.3 MANAGEMENT ASSESSMENT

#### PERFORMANCE OBJECTIVE

Management and supervisory personnel should monitor and assess plant maintenance activities to improve all aspects of maintenance performance.

#### CRITERIA

- A. Line managers and supervisors are responsible for and personally take part in monitoring and assessing maintenance activities. Assessments by other independent groups, such as quality assurance, are used by line managers and supervisors as a management tool to assist them in assessing maintenance performance.
- B. Managers and supervisors frequently tour the plant and observe ongoing work. Effective corrective actions are taken for noted problems.
- C. Senior managers monitor the assessment activities of their subordinate managers and supervisors.
- D. Management and supervisory assessment and improvement efforts are performance-oriented. Line managers and supervisors are responsible for determining and implementing corrective actions.
- E. Selected maintenance data reflecting plant performance are analyzed and trended, and the results are forwarded to appropriate levels of management.
- F. Root causes are determined for problems identified during monitoring of maintenance activities and by analysis of trends. Corrective actions are initiated and tracked to completion.
- G. Management assessments are conducted to determine the reasons for success or failure in achievement of objectives. Results are incorporated into future objectives.

#### A.4 PLANT MATERIAL CONDITION

##### PERFORMANCE OBJECTIVE

The material condition of the plant is maintained to support safe and reliable plant operation.

##### CRITERIA

- A. Systems and equipment are in good working order; examples of this include the following:
  - 1. Fluid system leaks are minimized.
  - 2. Equipment is appropriately protected from adverse environmental conditions.
  - 3. Instruments, controls, and associated indicators are calibrated, as required.
  - 4. Good lubrication practices are evident.
  - 5. Fasteners and supports are properly installed.
  - 6. Equipment, structures, and systems are properly preserved and insulated.
- B. Material deficiencies are identified and are in the work control system.
- C. Temporary repairs are minimized and permanent repairs are made when conditions permit.
- D. Temporary environmental protection (e.g., dust, humidity, freeze, shock) is provided for plant equipment when needed to support construction, outage, or maintenance activities.
- E. Newly installed or modified systems/equipment are verified to be in good working order prior to operational acceptance by the plant staff.

## A.5 WORK CONTROL SYSTEM

### PERFORMANCE OBJECTIVE

The control of maintenance work should support the completion of tasks in a safe, timely, and efficient manner such that safe and reliable plant operation is optimized.

### CRITERIA

- A. The work control system provides management with an accurate status of maintenance planning and outstanding maintenance work.
- B. Control of work is accomplished through the effective use of a priority system. The backlog of work is effectively managed.
- C. Work planning includes considerations such as material, tool, and manpower requirements; interdepartmental coordination; safety considerations; radiological protection requirements; and quality control requirements. Maintenance history records are considered where appropriate.
- D. The work to be accomplished is clearly defined by a work document that identifies or includes applicable procedures and/or instructions. Troubleshooting activities are controlled by applicable work documents.
- E. Advance planning is performed and routinely updated for scheduled and unscheduled outages. Considerations such as work priority, work procedures and instructions, plant/system conditions, length of outage required, prestaging of documents and material, and coordination of support activities are included.
- F. ALARA concepts are used in work planning to minimize man-rem exposure.
- G. Scheduling and coordination of maintenance activities avoids unnecessary removal of equipment and systems from service and uses manpower effectively.
- H. Postmaintenance testing requirements are clearly defined and include the following:

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1. clearly written test instructions
  2. test scope sufficient to verify the adequacy of work accomplished
  3. test acceptance criteria
- I. Postmaintenance test results are documented and reviewed to ensure proper system/equipment performance prior to returning the system to service.
- J. Completed work control documents are reviewed in a timely manner to check proper completion of maintenance work and to verify that corrective action resolved the problem.

## A.6 CONDUCT OF MAINTENANCE

### PERFORMANCE OBJECTIVE

Maintenance should be conducted in a safe and efficient manner to support plant operation.

### CRITERIA

- A. Personnel exhibit professionalism and competency in performing assigned tasks that results in quality workmanship.
- B. Maintenance personnel are attentive to identifying and are responsive to correcting plant deficiencies with a goal of maintaining equipment/systems in an optimum material condition.
- C. Managers and supervisors routinely observe maintenance activities to identify and correct problems and to ensure adherence to plant policies and procedures including industrial safety and radiation protection.
- D. Maintenance managers, supervisors, and craftsmen actively use ALARA concepts to minimize personnel exposure.
- E. Support groups such as operations, engineering, quality control, and radiological protection are appropriately involved in maintenance activities. Participation of these groups is coordinated to effectively support the maintenance effort.
- F. Maintenance work is properly authorized, controlled, and documented.
- G. Pre- and post-job briefings are effectively used.
- H. Work activities are performed in accordance with controlled procedures, instructions, and drawings as required by plant policy. Craftsmen and other maintenance personnel identify and provide feedback to correct procedural problems.
- I. Good maintenance practices such as those listed below are followed:
  - 1. Proper tools and equipment are used.
  - 2. Good industrial safety radiological protection, and ALARA practices are followed.

3. Foreign materials and contaminants are excluded from open systems and equipment.
  4. Work sites are clean and orderly.
- J. Appropriate personnel (e.g., operations, engineering, and maintenance) are aware of and perform postmaintenance testing, review results, and take corrective action, as necessary.
  - K. Maintenance rework is identified and documented. Corrective actions, including periodic reviews for generic implications, are taken to minimize rework.
  - L. Temporary and other non-plant personnel are properly supervised and work under the same controls and procedures, and to the same standards as plant maintenance personnel.

## A.7 PREVENTIVE MAINTENANCE

### PERFORMANCE OBJECTIVE

Preventive maintenance should contribute to optimum performance and reliability of plant systems and equipment.

### CRITERIA

- A. A preventive maintenance program is effectively implemented and includes systems and equipment that affect safe and reliable plant operation. Preventive maintenance includes equipment layup protective measures, where applicable.
- B. Preventive maintenance, including predictive maintenance activities, are performed at appropriate intervals. These intervals maximize equipment availability. Considerations such as operational experience, vendor recommendations, engineering analysis, and cost/benefit analysis are used as a basis to establish preventive maintenance tasks and intervals.
- C. Preventive maintenance activities are scheduled and performed within established intervals. Preventive maintenance is waived or deferred only with management approval.
- D. Preventive maintenance documentation provides a record of activities performed, data collected, and, where appropriate, the "as-found" and "as-left" condition of the equipment.
- E. Preventive maintenance techniques and results are used to assess equipment performance. Program adjustments are made and other corrective actions are taken where needed.
- F. The effectiveness of the preventive maintenance program is periodically evaluated at an appropriate level of management, and the results are used to make program improvements.

## A.8 MAINTENANCE PROCEDURES AND DOCUMENTATION

### PERFORMANCE OBJECTIVE

Maintenance procedures and other work-related documents should provide appropriate directions for work and should be used to ensure that maintenance is performed safely and efficiently.

### CRITERIA

- A. The preparation, review, approval, and revision of procedures and other work-related documents are properly controlled.
- B. Documents used in lieu of procedures (such as excerpts from vendor manuals) receive the same review and approval as procedures.
- C. Procedures and other work-related documents such as vendor manuals, drawings, reference materials, and posted job performance aids used in support of maintenance are technically accurate and up-to-date.
- D. Procedures are readily available and clearly identified.
- E. New and revised procedures are reviewed for technical accuracy prior to use, and are checked to ensure usability prior to or during initial use.
- F. Procedures are clear, concise, and contain adequate information for users to understand and perform their activities effectively.
  - 1. Portions or steps of other documents that are used or referred to when performing a procedure are specifically identified in the procedure.
  - 2. Technical details such as setpoints, control logic, and equipment numbers are consistent among procedures, drawings, valve lineup sheets, and system descriptions.
  - 3. Human factors considerations are incorporated into procedures to promote error-free performance.
- G. Hold points, such as quality and radiological protection checks, are included in procedures, as needed.

- H. A policy governing the use of procedures is implemented. The policy includes the following:
  - 1. Portions or steps of other documents that are used or referred to when performing a procedure are specifically identified in the procedure.
  - 2. Action to be taken when procedures conflict, are inadequate for the intended tasks, or when unexpected results occur.
  
- I. Temporary changes to procedures, if used, are effectively controlled, including the following:
  - 1. appropriate review and authorization prior to use
  - 2. user awareness of applicable temporary changes
  
- J. A formal program exists to periodically review procedures for technical accuracy, human factors considerations, and the inclusion of in-house and industry operating experience.

## A.9 MAINTENANCE HISTORY

### PERFORMANCE OBJECTIVE

Maintenance history should be used to support maintenance activities, upgrade maintenance programs, optimize equipment performance, and improve equipment reliability.

### CRITERIA

- A. Maintenance history records are maintained for systems, equipment, and components that affect safe and reliable plant operations.
- B. Maintenance work and inspection/test results are effectively documented.
- C. Maintenance history records are appropriately considered in planning for corrective maintenance, modifications, and preventive maintenance.
- D. Maintenance history records are readily available for use.
- E. Maintenance history is periodically reviewed to identify equipment trends and persistent maintenance problems, and to assess their impact on plant reliability. Maintenance program adjustments are made or other corrective actions are taken as needed.

## A.10 MAINTENANCE FACILITIES AND EQUIPMENT

### PERFORMANCE OBJECTIVE

Facilities and equipment should effectively support the performance of maintenance activities.

### CRITERIA

- A. Maintenance facilities size and arrangement promote the safe and effective completion of work. Facilities should be provided for work on contaminated components.
- B. Work area lighting and other environmental conditions promote safe and effective working conditions.
- C. Work areas are maintained in a clean and orderly condition.
- D. Proper tools, equipment, and consumable supplies are available to support work requirements.
- E. Suitable storage is provided for tools, supplies, and equipment. Special tools, jigs, and fixtures are identified and stored to permit retrieval when needed.
- F. Contaminated tools are segregated from clean tools to prevent cross-contamination. Reuse is stressed, when feasible.
- G. Scaffolding and rigging equipment is identified, tested, and properly stored.
- H. Facilities, equipment, and tools are maintained in good repair.
- I. Measuring and test equipment is calibrated and controlled to provide accuracy and traceability. Out-of-tolerance test equipment is removed from service. Plant equipment calibrated with out-of-tolerance test equipment is evaluated in a timely manner for operability and is recalibrated as necessary.
- J. Fixed local area hosts and work platforms are provided, as needed, to facilitate maintenance access to plant equipment.

## A.11 MATERIALS MANAGEMENT

### PERFORMANCE OBJECTIVE

Materials management should ensure that necessary parts and materials meeting quality and/or design requirements are available when needed.

### CRITERIA

- A. Programs are implemented to order, receive, and issue proper parts and materials for work activities. Stock levels are adjusted, as necessary, to meet plant needs.
- B. Procurement documents provide clear and adequate technical and quality assurance requirements consistent with design specifications. Areas such as storage, preventive maintenance, and shelf-life requirements are addressed. Proper engineering control and approval are obtained on any deviation from design specifications for parts or materials.
- C. Mechanisms are in place to provide for the expeditious procurement of parts and material on a high priority basis when needed.
- D. Methods are established to acquire replacement parts not available from the original supplier.
- E. Material is inspected to ensure conformance to purchasing requirements prior to release for use and storage. Documentation for received material is accounted for and retrievable. Non-conforming items are identified and controlled to prevent unauthorized use.
- F. Effective material procurement status is provided including accurate stock records, tracking of purchase orders, and maintaining traceability of safety-related parts and material.
- G. Materials are stored and identified in a manner that results in timely retrieval.
- H. Safety-related parts and components are properly controlled, segregated, and identified in all material storage areas.
- I. The quality of stored equipment, parts, and materials is maintained by appropriate means such as environmental and shelf-life controls, and preventive maintenance.

- J. Parts and materials issued for installation are properly controlled. Unused parts and materials are promptly returned to a controlled storage area. Safety-related parts are readily traceable from purchase to installation.
- K. Flammable and hazardous materials are identified, segregated, and properly controlled during receipt inspection, storage, and issue.
- L. Equipment and materials used by non-plant personnel are subject to inspection, storage, and issuance controls equivalent to items received through normal plant processes.
- M. Lessons learned from experience, such as lead times, parts usage, and supplier reliability, are factored into materials management.

A.12 MAINTENANCE PERSONNEL KNOWLEDGE AND PERFORMANCE

PERFORMANCE OBJECTIVE

Maintenance personnel knowledge and performance should support safe and reliable plant operation.

CRITERIA

- A. Maintenance is performed by or under the direct supervision of personnel who have completed applicable formal qualification associated with the tasks to be performed.
- B. Maintenance personnel knowledge is evidenced by an appropriate understanding of areas such as the following:
  - 1. maintenance policies and procedures
  - 2. general plant layout
  - 3. purpose and importance of plant/systems and equipment
  - 4. effect of work on plant systems
  - 5. industrial safety, including hazards associated with work on specific equipment/systems
  - 6. radiological protection and ALARA principles
  - 7. job-specific work practices
  - 8. cleanliness and housekeeping practices
- C. Maintenance personnel are capable of troubleshooting equipment problems in an efficient manner.
- D. Maintenance personnel, including temporary and non-plant personnel, are knowledgeable of changes to plant policies, procedures, systems, and equipment that affect their activities.
- E. Maintenance personnel are knowledgeable of appropriate lessons learned from industry and in-house operating experiences (including actual events) applicable to their craft.

## A.13 IN-HOUSE OPERATING EXPERIENCE REVIEW

### PERFORMANCE OBJECTIVE

In-house operating experiences should be evaluated, and appropriate actions should be undertaken to improve safety and reliability.

### CRITERIA

- A. In-house events are screened for significance and prioritized for evaluation.
- B. Rigorous investigation is performed on significant in-house events to determine root causes, generic implications, and necessary corrective actions to prevent recurrence.
- C. Relevant in-house and industry operating experience is reviewed as part of the investigation of significant in-house events.
- D. Significant in-house events receive a second, multi-disciplinary review to ensure that all concerns have been addressed.
- E. Timely notification is provided to other facilities of important in-house events of generic interest.
- F. Post-scrum reviews are comprehensive and include the following:
  - 1. identification and resolution of the cause(s) of the trip
  - 2. identification and resolution of discrepancies between actual and expected plant responses to the trip
  - 3. documentation to support results and recommendations
- G. Pertinent in-house operating experience information is distributed to appropriate personnel and departments and recommended corrective actions are completed in a timely manner.
- H. In-house events are trended to identify recurring problems and determine appropriate corrective actions.

## A.14 INDUSTRY OPERATING EXPERIENCE REVIEW

### PERFORMANCE OBJECTIVE

Significant industry operating experiences should be evaluated, and appropriate actions should be undertaken to improve safety and reliability.

### CRITERIA

- A. A comprehensive evaluation is performed on applicable, significant industry operating experience, and appropriate corrective action is completed in a timely manner.
- B. Sources of significant industry operating experience information reviewed for applicability include the following:
  - 1. DOE letters, bulletins, and information notices
  - 2. Lessons Learned and Alert System
  - 3. Supplier and architect/engineer reports
- C. Appropriate checks are performed to verify that industry operating experience information is being properly classified for applicability.
- D. Applicable significant industry operating experience information is distributed to appropriate personnel and departments in a timely manner.
- E. Distribution of conflicting or extraneous industry operating experience information to operators and other personnel is minimized.



**APPENDIX B**  
**MAINTENANCE ORGANIZATION AND ADMINISTRATION**  
**SAMPLE LESSON PLAN**



**MAINTENANCE ORGANIZATION & ADMINISTRATION  
SAMPLE LESSON PLAN**

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LESSON PLAN

1. The instructor should be familiar with the following background information:
  - a. The effective implementation and control of maintenance activities are primarily achieved by:
    - establishing written standards, and
    - periodically observing, assessing, and holding maintenance personnel accountable for their performance.
  - b. An effective facility maintenance program is achieved through the constructive integration of the following:
    - the setting of high standards of maintenance by senior management,
    - productive communication of these standards to all personnel who perform maintenance,
    - selection and training of high quality personnel,
    - establishment of attainable goals and objectives,
    - promotion of craftsmanship by closely observing and assessing maintenance performance in the field,
    - efficient coordination of maintenance activities with supporting departments, and
    - holding maintenance workers and their supervisors accountable for their individual performance.
  - c. Performance standards for all maintenance activities should be integrated into maintenance department procedures and programs. They can be communicated by training, and reinforced through supervision of work activities.

- d. All maintenance personnel should be held accountable for their performance by means of counseling, performance appraisals, and appropriate disciplinary measures.
2. To teach this lesson, the following training housekeeping items are required:
    - a. Location for the training,
    - b. Approximately 30 minute time period for the training,
    - c. Notification of selected employees, and
    - d. A copy of the site's maintenance division organization chart, policies & procedures, and goals & objectives.
  3. This lesson has the following trainee enabling objectives:
    - a. State the facilities maintenance division's policies,
    - b. Explain the concept of a maintenance strategy, and
    - c. Outline the maintenance division's goals and objectives.
  4. Explain to the trainees the following concepts of organization and administration:
    - a. An important component of any business is the "how" of how you do business. This is commonly referred to as a business plan within which personnel perform specific tasks and the organization itself supports the overall function of a facility. A maintenance division's policies are a major part of this "how" and should:
      - be designed to support corporate and site policies and programs,
      - be incorporated into appropriate maintenance procedures, and
      - clearly define the maintenance personnel's authority, responsibility, accountability, and interfaces with other departments.

- b. From a maintenance standpoint, another important part of this "how" is a strategy to adequately support the facility and its equipment through its remaining years of operation. This includes the following:
    - the review of organizational structure and staffing to support both the continuing improvements in the maintenance program and the facility as a whole,
    - long-range planning for equipment replacement as components reach end of service life,
    - the timing of planned maintenance in conjunction with downtime of important pieces of site equipment,
    - incorporating relevant industry issues and events into the maintenance program, and
    - adequate resources for major projects, modifications, and initiatives that will require the maintenance organization's involvements.
  - c. A commonly used method to improve an organizations's performance involves setting goals. If realistic, challenging, and measurable maintenance departmental goals are established, then the effectiveness of maintenance can be monitored and improvements achieved. Examples of maintenance goals include the following:
    - minimize the length of equipment downtime by planning and completing maintenance activities in a timely manner.
    - minimize the number of forced downtime events,
    - minimize the lost time accident rate,
    - reduce the amount of contaminated floor space,
    - reduce the number of overdue preventive maintenance activities, and
    - reduce the backlog of outstanding corrective maintenance deficiencies.
5. Discuss with the trainees the organization chart, maintenance division policies, and goals and objectives. Emphasize a clear understanding of each item.



## CONCLUDING MATERIAL

### Review Activities:

<u>DOE</u>	<u>Field Offices</u>
AD	AL
DP	CH
EH	ID
EM	NV
ER	OR
NP	RL
NS	SR
RW	SF

### Area Offices

Amarillo  
Brookhaven  
Kansas City  
Kirtland  
Princeton

### Facilities

ANL  
BNL  
LBL  
PNL  
PPPL  
SNL  
NV REECo.  
NV EG&G  
OR OSTI  
WHC  
EG&G  
RF  
SLAC  
WSRC

### Preparing Activity:

DOE-NE-73

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**United States Department of Energy**  
**Office of Scientific and Technical Information**  
Post Office Box 62  
Oak Ridge, Tennessee 37831